S.G.A. GOVERNMENT DEGREE COLLEGE (A)

(Re-Accredited with NAAC "A" Grade with CGPA 3.13)

Affiliated to Andhra University

YELLAMANCHILI, ANAKAPALLI DIST., ANDHRA PRADESH

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

Programme: B.Sc. Hons in Zoology (Major)

w.e.f. AY 2024-25 & 2025-26

COURSE STRUCTURE

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Introduction to Classical Biology	3+2	4
	I	2	Introduction to Applied Biology	3+2	4
	II	3	Animal Diversity-I Biology of Non-Chordates	3	3
			Animal Diversity-I Biology of Non-Chordates Practical Course	2	1
	II	4	Cell and Molecular Biology	3	3
			Cell and Molecular Biology Practical Course	2	1
II	III	5	Animal Diversity-II Biology of Chordates	3	3
			Animal Diversity-II Biology of Chordates Practical Course	2	1
		6	Principles of Genetics	3	3
			Principles of Genetics Practical Course	2	1
		7	Animal Biotechnology	3	3
			Animal Biotechnology Practical Course	2	1
		8	Evolution and Zoogeography	3	3
			Evolution and Zoogeography Practical Course	2	1
	IV	9	Embryology	3	3
			Embryology Practical Course	2	1
		10	Animal Physiology: Life Sustaining Systems	3	3
			Animal Physiology: Life Sustaining Systems Practical Course	2	1
		11	Immunology	3	3
			Immunology Practical Course	2	1

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
III	V	12	Poultry Management-I (Poultry Farming)	3	3
			Poultry Management-I (Poultry Farming) Practical Course	2	1
		13	Poultry Management-II (Poultry Production and Management)	3	3
			Poultry Management-II (Poultry Production and Management)Practical Course	2	1
		14 A	Sustainable Aquaculture Management	3	3
			Sustainable Aquaculture Management Practical Course	2	1
		OR			
		14 B	Live Stock Management- I (Biology of Dairy Animals)	3	3
			Live Stock Management- I (Biology of Dairy Animals)Practical Course	2	1
		15 A	Post-Harvest Technology of Fish and Fisheries	3	3
			Post-Harvest Technology of Fish and Fisheries Practical Course	2	1
		OR			
		15 B	Live Stock Management-II (Dairy Production and Management)	3	3
			Live Stock Management-II (Dairy Production and Management)Practical Course	2	1
	VI	**Internship**			
	VII		Courses will be available in due course of time		
	VIII		Courses will be available in due course of time		

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DEPARTMENT OF ZOOLOGY

B.Sc Zoology (Hons.) Single Major

Program Outcomes (POs)

POs	Programme Outcomes
PO1	**Knowledge Acquisition**: • Gain in-depth understanding of the principles of biology, specifically animal biology, and how organisms interact with their environment. • Demonstrate knowledge of various branches of Zoology, including genetics, evolution, physiology, ecology, and cell biology.
PO2	**Critical Thinking and Problem Solving**: • Apply scientific methods and principles to solve biological problems. • Use analytical skills to evaluate scientific data and draw conclusions.
PO3	**Research Skills**: • Develop the ability to conduct independent research in Zoology, including data collection, analysis, and presentation. • Understand ethical considerations in scientific research, including animal ethics and environmental conservation.
PO4	**Sustainability and Environmental Awareness**: • Understand the importance of biodiversity and conservation and recognize the role of Zoologists in addressing global challenges such as habitat loss, climate change, and species extinction.
PO5	**Interdisciplinary Integration**: • Integrate knowledge from various scientific fields (e.g., chemistry, physics, and environmental science) to enhance the understanding of Zoology

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DEPARTMENT OF ZOOLOGY

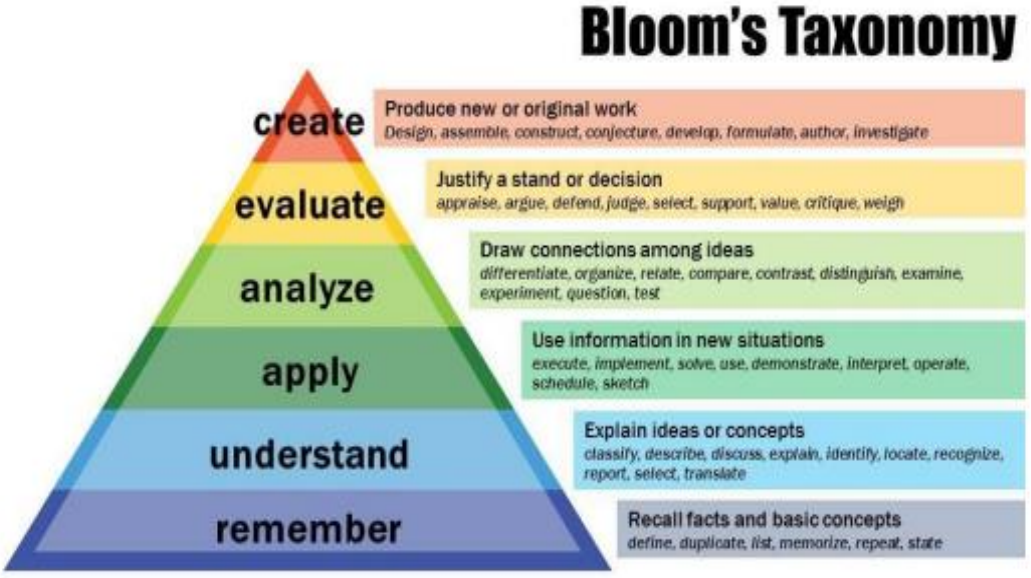
B.Sc Zoology (Hons.) Single Major

Program Specific Outcomes (PSOs)

PSOs	Programme Specific Outcomes
PSO1	Gain an in-depth understanding of the physiological systems of animals, including nervous, muscular, respiratory, circulatory, and excretory systems.
PSO2	Demonstrate comprehensive knowledge of the diverse animal kingdom, including classification, physiology, anatomy, and behavior.
PSO3	Understand genetic principles, molecular biology techniques, and evolutionary processes that shape animal species.
PSO4	Understand the concepts of taxonomy, systematics, and the identification of animals, and understand their role in biodiversity conservation.
PSO5	Recognize the importance of ethical issues related to animal research, environmental conservation, and sustainable development in the field of Zoology.

LEVELS OF BLOOM'S TAXONOMY:

Level-1	**Knowledge/Remember**
Level-2	**Understand**
Level-3	**Application**
Level-4	**Analyze**
Level-5	**Evaluation**
Level-6	**Create**



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I YEAR - SEMESTER –I

COURSE 1: INTRODUCTION TO CLASSICAL BIOLOGY

Theory **Credits: 4** **5hrs/Week**

Learning objectives

The student will be able to learn the diversity and classification of living organisms and understand their chemical, cytological, evolutionary and genetic principles.

Learning Outcomes

CO1: Learn the principles of classification and preservation of biodiversity

CO2: Understand the plant anatomical, physiological and reproductive processes.

CO3: Knowledge on animal classification, physiology, embryonic development and their economic importance.

CO4: Outline the cell components, cell processes like cell division, heredity and molecular processes.

CO5: Comprehend the chemical principles in shaping and driving the macromolecules and life processes.

Unit 1: Introduction to systematics, taxonomy and ecology.

1.1 Systematics – Definition and concept, Taxonomy – Definition and hierarchy.

1.2 Nomenclature – ICBN and ICZN, Binomial and trinomial nomenclature.

1.3 Ecology – Concept of ecosystem, Biodiversity and conservation.

1.4 Pollution and climate change.

Unit 2: Essentials of Botany

2.1. The classification of plant kingdom.

2.2. Plant physiological processes (Photosynthesis, Respiration, Transpiration, phytohormones).

2.3. Structure of flower – Micro and macro sporogenesis, pollination, fertilization and structure of mono and dicot embryos.

2.4 Mushroom cultivation, floriculture and landscaping.

Unit 3: Essentials of Zoology

3.1. The classification of Kingdom Animalia and Chordata.

3.2 Animal Physiology – Basics of Organ Systems & their functions, Hormones and Disorders

3.3 Developmental Biology – Basic process of development (Gametogenesis, Fertilization, Cleavage and Organogenesis)

3.4 Economic Zoology – Sericulture, Apiculture, Aquaculture

Unit 4: Cell biology, Genetics and Evolution

4.1. Cell theory, Ultrastructure of prokaryotic and eukaryotic cell, cell cycle.

4.2. Chromosomes and heredity – Structure of chromosomes, concept of gene.

4.3 Central Dogma of Molecular Biology.

4.4 Origin of life

Unit 5: Essentials of chemistry

5.1. Definition and scope of chemistry, applications of chemistry in daily life.

5.2 Branches of chemistry

5.3 Chemical bonds – ionic, covalent, noncovalent – Vander Waals, hydrophobic, hydrogen bonds.

5.4 Green chemistry

References

1. Sharma O.P., 1993. Plant taxonomy. 2nd Edition. McGraw Hill publishers.
2. Pandey B.P., 2001. The textbook of botany Angiosperms. 4th edition. S. Chand publishers, New Delhi, India.
3. Jordan E.L., Verma P.S., 2018. Chordate Zoology. S. Chand publishers, New Delhi, India.
4. Rastogi, S.C., 2019. Essentials of animal physiology. 4th Edition. New Age International Publishers.
5. Verma P.S., Agarwal V.K., 2006. Cell biology, genetics, Molecular Biology, Evolution and Ecology. S. Chand publishers, New Delhi, India.
6. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
7. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
8. Karen Timberlake, William Timberlake, 2019. Basic chemistry. 5th Edition. Pearson publishers.
9. Subrata Sen Gupta, 2014. Organic chemistry. 1st Edition. Oxford publishers.

ACTIVITIES:

1. Make a display chart of life cycle of nonflowering plants.

2. Make a display chart of life cycle of flowering plants.

3. Study of stomata

4. Activity to prove that chlorophyll is essential for photosynthesis

5. Study of pollen grains.

6. Observation of pollen germination.

7. Ikebana.

8. Differentiate between edible and poisonous mushrooms.

9. Visit a nearby mushroom cultivation unit and know the economics of mushroom cultivation.

10. Draw the Ultrastructure of Prokaryotic and Eukaryotic Cell

11. Visit to Zoology Lab and observe different types of preservation of specimens

12. Hands-on experience of various equipment – Microscopes, Centrifuge, pH Meter,

    Electronic Weighing Balance, Laminar Air Flow

13. Visit to Zoo / Sericulture / Apiculture / Aquaculture unit

14. List out different hormonal, genetic and physiological disorders from the society

I YEAR - SEMESTER –I

COURSE 2: INTRODUCTION TO APPLIED BIOLOGY

Theory **Credits: 4** **5hrs/Week**

Learning objectives

The student will be able to learn the foundations and principles of microbiology, immunology, biochemistry, biotechnology, analytical tools, quantitative methods, and bioinformatics.

Learning Outcomes

CO1: earn the history, ultrastructure, diversity and importance of microorganisms.

CO2:Understand the structure and functions of macromolecules.

CO3:Knowledge on biotechnology principles and its applications in food and medicine

CO4: Outline the techniques, tools and their uses in diagnosis and therapy.

CO4: Demonstrate the bioinformatics and statistical tools in comprehending the complex biological data.

Unit 1: Essentials of Microbiology and Immunology

1.1 History and Major Milestones of Microbiology; Contributions of Edward Jenner, Louis Pasteur, Robert Koch and Joseph Lister.

1.2 Groups of Microorganisms – Structure and characteristics of Bacteria, Fungi, Archaea and Virus.

1.3Applications of microorganisms in – Food, Agriculture, Environment, and Industry.

1.4Immune system – Immunity, types of immunity, cells and organs of immune sys1tem

Unit 2: Essentials of Biochemistry

2.1 Biomolecules I – Carbohydrates, Lipids.

2.2 .6Biomolecules II – Amino acids & Proteins.

2.3 Biomolecules III – Nucleic acids -DNA and RNA.

2.4 Basics of Metabolism – Anabolism and catabolism

Unit 3: Essentials of Biotechnology

3.1 History, scope, and significance of biotechnology. Applications of biotechnology in Plant, Animal, Industrial and Pharmaceutical sciences.

3.2 Environmental Biotechnology – Bioremediation and Biofuels, Biofertilizers and Biopesticides.

3.3 Genetic engineering – Gene manipulation using restriction enzymes and cloning vectors; Physical, chemical, and biological methods of gene transfer.

3.4 Transgenic plants – Stress tolerant plants (biotic stress – BT cotton, abiotic stress – salt tolerance). Transgenic animals – Animal and disease models.

Unit 4: Analytical Tools and techniques in biology – Applications

4.1 Applications in forensics – PCR and DNA fingerprinting

4.2 Immunological techniques – Immunoblotting and ELISA.

4.3 Monoclonal antibodies – Applications in diagnosis and therapy.

4.4 Eugenics and Gene therapy

Unit 5: Biostatistics and Bioinformatics

5.1 Data collection and sampling. Measures of central tendency – Mean, Median, Mode.

5.2 Measures of dispersion – range, standard deviation and variance. Probability and tests of significance.

5.3Introduction, Genomics, Proteomics, types of Biological data, biological databases- Gene Bank; ,Protein Primary, Secondary and 3D structures, Sequence alignment

5.4 Accessing Nucleic Acid and Protein databases, NCBI Genome Workbench

REFERENCES

1. Gerard J., Tortora, Berdell R. Funke, Christine L. Case., 2016. Microbiology: An Introduction. 11th Edition. Pearson publications, London, England.
2. Micale, J. Pelczar Jr., E.C.S. Chan., Noel R. Kraig., 2002. Pelczar Microbiology. 5th Edition. McGraw Education, New York, USA.
3. Sathyanarayana U., Chakrapani, U., 2013. Biochemistry. 4th Edition. Elsevier publishers.
4. Jain J.L., Sunjay Jain, Nitin Jain, 2000. Fundamentals of Biochemistry. S. Chand publishers, New Delhi, India.
5. R.C. Dubey, 2014. Advanced Biotechnology. S. Chand Publishers, New Delhi, India.
6. Colin Ratledge, Bjorn, Kristiansen, 2008. Basic Biotechnology. 3rd Edition. Cambridge Publishers.
7. U. Sathyanarayana, 2005. Biotechnology. 1st Edition. Books and Allied Publishers pvt. ltd., Kolkata.
8. Upadhyay, Upadhyay and Nath. 2016. Biophysical Chemistry, Principles and Techniques. Himalaya Publishing House.
9. Arthur M. Lesk. Introduction to Bioinformatics. 5th Edition. Oxford publishers.
10. AP Kulkarni, 2020. Basics of Biostatistics. 2nd Edition. CBS publishers.

ACTIVITIES

1. Identification of given organism as harmful or beneficial.
2. Observation of microorganisms from house dust under microscope.
3. Finding microorganism from pond water.
4. Visit to a microbiology industry or biotech company.
5. Visit to a waste water treatment plant.
6. Retrieving a DNA or protein sequence of a gene’

7. Performing a BLAST analysis for DNA and protein.
8. Problems on biostatistics.
9. Field trip and awareness programs on environmental pollution by different types of wastes and hazardous materials.
10. Demonstration on basic biotechnology lab equipment.
11. Preparation of 3D models of genetic engineering techniques.
12. Preparation of 3D models of transgenic plants and animals.

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I YEAR - SEMESTER –II

COURSE 3: ANIMAL DIVERSITY – I BIOLOGY OF NON- CHORDATES

Theory **Credits: 3** **3 hrs/Week**

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of Chemistry, Botanical, and Zoological sciences. The course aims to understand the taxonomic position and origin and evolutionary relationship of different phylum

Course outcomes:

CO1: Describe concept of animal kingdom classification and general characters of Protozoa
CO2: Classify Porifera and Coelenterata with taxonomic keys
CO3: Classify Phylum Platy & Nemathelminthes using examples, parasitic adaptation
CO4: Describe Phylum Annelida & Arthropoda using examples and economic importance of vermicomposting & economic importance of insects.
CO5: Describe Mollusca, Echinodermata & Hemichordata with suitable examples in relation to the phylogeny

SYLLABUS:

UNIT-I
1.1 Whittaker's five kingdom concept.
1.2 Protozoa General Characters and classification up to classes with suitable examples
1.3 Protozoa Locomotion & nutrition
1.4 Protozoa reproduction

UNIT –II
2.1 Porifera General characters and classification up to classes with suitable examples
2.2 Canal system in sponges
2.3 Coelenterata General characters and classification up to classes with suitable examples
2.4 Polymorphism in coelenterates & Corals and coral reefs

UNIT – III
3.1 Platyhelminthes General characters and classification up to classes with suitable examples
3.2 Parasitic Adaptations in helminthes
3.3 Nemathelminthes General characters and classification up to classes with suitable examples
3.4 Life cycle and pathogenicity of Ascaris lumbricoides

UNIT – IV
4.1 Annelida General characters and classification up to classes with suitable examples

4.2 Vermiculture - Scope, significance, earthworm species, processing, Vermicompost, economic importance of vermicompost
4.3 Arthropoda General characters and classification up to classes with suitable examples

4.4 Peripatus - Structure and affinities

UNIT – V

5.1 Mollusca General characters and classification up to classes with suitable examples
5.2 Pearl formation in Pelecypoda
5.3 Echinodermata General characters and classification up to classes with suitable examples Water vascular system in star fish
5.4 Hemichordata General characters and classification up to classes with suitable examples Balanoglossus - Structure and affinities

REFERENCE BOOKS:

- L.H. Hyman „The Invertebrates' Vol I, II and V. – M.C. Graw Hill Company Ltd.
- Kotpal, R.L. 1988 - 1992 Protozoa, Porifera, Coelenterata, Helminthes, Arthropoda, Mollusca, Echinodermata. Rastogi Publications, Meerut.
- E.L. Jordan and P.S. Verma „Invertebrate Zoology' S. Chand and Company.
- R.D. Barnes „Invertebrate Zoology' by: W.B. Saunders CO., 1986.
- Barrington. E.J.W., „Invertebrate structure and Function' by ELBS.
- P.S. Dhami and J.K. Dhami. Invertebrate Zoology. S. Chand and Co. New Delhi.
- Parker, T.J. and Haswell„A text book of Zoology' by, W.A., Mac Millan Co.London.
- Barnes, R.D. (1982). Invertebrate Zoology, V Edition"

Student Activities

- Preparation of chart/model of phylogenic tree of life, 5-kingdom classification
- Visit to Zoology Museum or Coral Island as part of Zoological tour
- Charts on polymorphism
- Clay models of canal system in sponges
- Plaster-of-paris model of Peripatus
- Construction of a vermicompost in each college, manufacture of manure by students and donating to local farmers
- Chart on pearl forming layers using clay
- Visit to a pearl culture rearing industry/institute
- Live model of water vascular system
- Observation of Balanoglossus for its tubicolous habit

I YEAR - SEMESTER –II
COURSE 3: ANIMAL DIVERSITY – I BIOLOGY OF NON- CHORDATES

Practical **Credits: 1** **2 hrs/Week**

LEARNING OBJECTIVES:

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labelled record of identified museum specimens

SYLLABUS

Study of museum slides / specimens / models (Classification of animals up to orders)

- Protozoa: Amoeba, Paramoecium, Paramoecium Binary fission and Conjugation, Vorticella, Entamoeba histolytica, Plasmodium vivax
- Porifera: Sycon, Spongilla, Euspongia, Sycon- T.S & L.S, Spicules, Gemmule
- Coelenterata: Obelia – Colony & Medusa, Aurelia, Physalia, Velella, Corallium,Gorgonia, Pennatula
- Platyhelminthes: Planaria, Fasciola hepatica, Fasciola larval forms – Miracidium,Redia, Cercaria, Echinococcus granulosus, Taenia solium, Schistosoma haematobium
- Nemathelminths: Ascaris (Male & Female), Drancunculus, Ancylostoma,Wuchereria
- Annelida: Nereis, Aphrodite, Chaetopteurs, Hirudinaria, Trochophore larva
- Arthropoda: Cancer, Palaemon, Scorpion, Scolopendra, Sacculina, Limulus, Peripatus, Larvae - Nauplius, Mysis, Zoea, Mouth parts of male &female Anophelesand Culex, Mouthparts of Housefly and Butterfly.
- Mollusca:Chiton, Pila, Unio, Pteredo, Murex, Sepia, Loligo, Octopus, Nautilus, Glochidium larva
- Echinodermata: Asterias, Ophiothrix, Echinus, Clypeaster, Cucumaria, Antedon, Bipinnaria larva
- Hemichordata: Balanoglossus, Tornaria larva

Dissections:

Computer - aided techniques should be adopted or show virtual dissections Dissection of edible (Prawn/Pila) invertebrate as per UGC guidelines

An **"Animal album"** containing photographs, cut outs, with appropriate write up about the abovementioned taxa. Different taxa/ topics will be given to different sets of students for this purpose

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I YEAR - SEMESTER –II

COURSE 4: CELL AND MOLECULAR BIOLOGY

Theory **Credits: 3** **3 hrs/Week**

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the basic concepts and applications Cell and Molecular Biology and biological importance of Biomolecules

Course Outcomes:

CO1: • Understand the basic unit of the living organisms and to differentiate the organisms by their cell structure.
CO2:• Describe fine structure and function of plasma membrane and different cell organelles of eukaryotic cell.
CO3:• Explain the cell cycle and bioenergetics of the cell
CO4:• Understand the central dogma of molecular biology and flow of genetic information from DNA to proteins
CO5:• Understand the gene expression phenomenon and biological importance of biomolecules

SYLLABUS:

UNIT – I Cell Biology-I
1.1 Definition, history, prokaryotic and eukaryotic cells, virus, viroids, mycoplasma
1.2 Electron microscopic structure of animal cell.
1.3 Plasma membrane –Models and Fluid mosaic model
1.4 Transport functions of plasma membrane-Active – passive- facilitated

UNIT – II Cell Biology-II
2.1 Structure and functions of Golgi complex & Endoplasmic Reticulum
2.2 Structure and functions of Lysosomes & Ribosomes
2.3 Structure and functions of Mitochondria & Centriole
2.4 Structure and functions of Nucleus & Chromosomes

UNIT – III Cell Biology-III
3.1 Cell Division- mitosis, meiosis
3.2 Cell cycle – stages- check points- regulation
3.3 Abnormal cell growth- cancer- apoptosis
3.4 Bio energetics- Glycolysis-Krebs cycle-ETS

UNIT IV: Molecular Biology-I
4.1 Central Dogma of Molecular Biology
4.2 Basic concepts of - DNA replication – Overview (Semi-conservative mechanism, Semi discontinuous mode, Origin & Propagation of replication fork)
4.3 Transcription in prokaryotes – Initiation, Elongation and Termination, Post-transcriptional modifications (basics)

4.4 Translation – Initiation, Elongation and Termination

UNIT V: Molecular Biology-II

5.1 Gene Expression in prokaryotes (Lac Operon); Gene Expression in eukaryotes
5.2 Biomolecules- Carbohydrates (Glucose- structure-properties- biological importance only)
5.3 Biomolecules- Protein (Amino acid- structure- properties- biological importance only)
5.4 Biomolecules- Lipids (Fatty acid- structure - properties- biological importance only)

REFERENCES:

- Lodish, Berk, Zipursky, Matsudaria, Baltimore, Darnell „Molecular Cell Biology"W.H. Freeman and company New York.
- Cell Biology by De Robertis
- Bruce Alberts, Molecular Biology of the Cell
- Rastogi, Cytology
- Varma & Aggarwal, Cell Biology
- C.B. Pawar, Cell Biology
- Molecular Biology by Frei fielder
- Instant Notes in Molecular Biology by Bios scientific publishers and Viva Books Private Limited
- James D. Watson, Nancy H. Hopkins „Molecular Biology of the Gene"

STUDENT ACTIVITIES

- Model of animal cell
- Working model of mitochondria to encourage creativity among students
- Photo album of scientists of cell biology
- Charts on plasma membrane models/cell organelles
- Charts on central dogma/lac operon/genetic code
- Model of semi-conservative model of DNA replication
- Power point presentation of any of the above topics by students

COURSE 4: CELL AND MOLECULAR BIOLOGY

Practical **Credits: 1** **2 hrs/Week**

LEARNING OBJECTIVES:

- Acquainting and skill enhancement in the usage of laboratory microscope
- Hands-on experience of different phases of cell division by experimentation
- Develop skills on human karyotyping and identification of chromosomal disorders
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny ad geological history of origin & evolution of animals

SYLLABUS:

1. Preparation of temporary slides of Mitotic divisions with onion root tips
2. Observation of various stages of Mitosis with prepared slides
3. Observation of various stages of Meiosis with prepared slides
4. Mounting of salivary gland chromosomes of Chironomus
5. Test for carbohydrate in given biological sample (Benedicts test)
6. Test for Protein in given biological sample (Nitric acid test -white ring)
7. Test for lipid in the given biological sample (Saponification test)

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SEMESTER - III

COURSE 5: ANIMAL DIVERISTY-II BIOLOGY OF CHORDATES

Theory **Credits: 3** **3hrs/week**

Course Objectives:

- To understand the animal kingdom.
- To understand the taxonomic position of Protochordata to Mammalia.
- To understand the general characteristics of animals belonging to Fishes to Reptilians.
- To understand the body organization of Chordata.
- To understand the taxonomic position of Protherian mammals.

Course Outcomes: By the completion of the course the graduate should able to –

CO1: Describe general taxonomic rules on animal classification of chordates
CO2: Classify Protochordata to Mammalia with taxonomic keys
CO3: Understand Mammals with specific structural adaptations
CO4: Understand the significance of dentition and evolutionary significance
CO5: Understand the origin and evolutionary relationship of different phyla from Prochordata toMammalia.

SYLLABUS:

UNIT - I

1.1 General characters and classification of Chordata up to classes
1.2 Salient features of Cephalochordata, Salient features of Urochordata
1.3 Structure of *Herdmania*, Life Cycle and Retrogressive metamorphosis –Process andSignificance
1.4 Cyclostomata, General characters, Comparison of Petromyzon and Myxine

Activity: Model preparation /Assignment /Students Seminar/Quiz/Project/Peer teaching/Reportwriting after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the aboveactivity

UNIT - II

2.1 General characters of Fishes, Salient features of Dipnoi
2.2 *Scoliodon*: External features, Digestive system, Respiratory system
2.3 *Scoliodon* Structure and function of Heart, Structure and functions of the Brain.
2.4 Migration in Fishes, Types of Scales

Activity:Model preparation/Assignment/Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the aboveactivity

UNIT - III

3.1 General characters of Amphibia, General characters of Reptilia
3.2 *Rana hexadactyla*: External features, Respiratory system, Structure and function of Heart
3.3 *Rana hexadactyla* structure and functions of the Brain
3.4 *Calotes*: External features, Digestive system, structure and function of Brain
3.5 Identification of Poisonous snakes

Activity: Model preparation /Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT - IV

4.1 General characters of Aves
4.2 *Columba livia*: External features, Digestive system, Respiratory system
4.3 *Columba livia*: Structure and function of Heart, structure and function of Brain
4.4 Migration in Birds, Flight adaptation in birds

Activity: Model preparation/Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT - V

5.1 General characters of Mammalia
5.2 Classification of Mammalia up to sub - classes with examples
5.3 Dentition in mammals, Adaptations in Aquatic mammals

Activity: Model preparation/Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (suggested)

- Preparation of charts on Chordate classification (with representative animal photos) and retrogressive metamorphosis
- Clay models of Herdmania and Amphioxus
- Visit to local fish market and identification of local cartilaginous and bony fishes
- Maintaining of aquarium by students
- Model of fish heart and brain
- Preparation of slides of scales of fishes
- Visit to local/nearby river to identify migratory fishes and prepare study notes
- Preparation of Charts on above topics by students (Eg: comparative account of vertebrate heart/brain/lungs, identification of snakes etc.)
- Collecting and preparation of Museum specimens with dead frogs/snakes/lizards etc., and/or their skeletons
- Additional input on types of snake poisons and their antidotes (student activity).
- Collection of bird feathers and submission of report on Plumology
- Taxidermic preparation of dead birds for Zoology Museum
- Map pointing of prototherian and metatherian mammals
- Chart preparation for dentition in mammals

REFERENCE BOOKS

- J.Z. Young, 2006. The life of vertebrates. (The Oxford University Press, New Delhi). 646 pages. Reprinted
- Arumugam, N. Chordate Zoology, Vol. 2. Saras Publication. 278 pages. 200 figs.
- A.J. Marshall, 1995. Textbook of zoology, Vertebrates. (The McMillan Press Ltd., UK). 852 pages. (Revised edition of Parker &Haswell, 1961).
- M. Ekambaranatha Ayyar, 1973. A manual of zoology. Part II. (S. Viswanathan Pvt. Ltd., Madras).
- P.S. Dhami & J.K. Dhami, 1981. Chordate zoology. (R. Chand & Co.). 550 pages.
- Gurdarshan Singh & H. Bhaskar, 2002. Advanced Chordate Zoology. Campus Books, 6 Vols., 1573 pp., tables, figs.
- A.K. Sinha, S. Adhikari& B.B. Ganguly, 1978. Biology of animals. Vol. II. Chordates. (New Central Book Agency, Calcutta). 560 pages.
- R.L. Kotpal, 2022. Modern textbook of zoology, Vertebrates. (Rastogi Publ., Meerut). 632 pages.
- E.L. Jordan & P.S. Verma, 1998. Chordate zoology. (S. Chand & Co.). 1092 pages.
- G.S. Sandhu, 2005. Objective Chordate Zoology. Campus Books, vii, 169 pp.
- Sandhu, G.S. & H. Bhaskar, H. 2004. Textbook of Chordate Zoology. Campus Books, 2 vols., xx, 964 p., figs.
- Veena, 2008. Lower Chordata. (Sonali Publ.), 374 p., tables, 117 figs.

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SEMESTER - III

COURSE 5: ANIMAL DIVERISTY-II BIOLOGY OF CHORDATES

Practical **Credits: 1** **2 hrs/week**

LEARNING OBJECTIVES

- To understand the importance of preservation of museum specimens
- To identify animals based on special identifying characters
- To understand different organ systems through demo or virtual dissections
- To maintain a neat, labeled record of identified museum specimens

SYLLABUS:

1. Protochordata: *Herdmania, Amphioxus, Amphioxus* T.S through pharynx.
2. Cyclostomes: *Petromyzon and Myxine.*
3. Pisces: *Pristis, Torpedo, Hippocampus, Exocoetus, Echeneis, Labeo, Catla,Clarius, Channa, Anguilla*.
4. Amphibia: *Ichthyophis, Amblystoma, Axolotl larva, Hyla,*
5. Reptilia: *Draco, Chamaeleon, Uromastix, Testudo, Trionyx, Russels viper, Naja,* Krait, *Hydrophis, Crocodile.*
6. Aves: *Psittacula, Eudynamis, Bubo, Alcedo.*
7. Mammalia: *Ornithorhynchus, Pteropus, Funambulus.*
8. **Dissections**-As per UGC guidelines
   - *Scoliodon IX* and X, Cranial nerves
   - *Scoliodon* Brain
   - Mounting of fish scales
9. Project Report on Identification of locally available fishes and Faunal Diversity

Note: 1. Dissections are to be demonstrated through virtual lab.(Amruta Lab)_
2. Laboratory Record work shall be submitted at the time of practical examination.

RFERENCE WEB LINKS:

- https://nt7-mhe-complex-assets.mheducation.com/nt7-mhe-complex-assets/Upload-20190715/InspireScience6-8CA/LS15/index.html
- https://themammallab.com/
- http://abacus.bates.edu/acad/depts/biobook/LabConCh.htm
- https://virtualzoology.wordpress.com/scoliodon/
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf

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SEMESTER - III
COURSE 6: PRINCIPLES OF GENETICS

Theory | Credits: 3 | 3 hrs/week

Course Objectives:

- To provide the background knowledge on the history of genetics and the importance of Mendelian principles.
- To provide the required knowledge on the gene interactions
- To acquaint the students, distinguish between polygenic, sex-linked, and multiple allelic modes of inheritance and extrachromosomal inheritance.
- To understand the principles of sex determination in animals with a reference to human being, and sex-linked inheritance
- To understand the human karyotyping and the concept of pedigree analysis basics.

Course Outcomes:

CO1: To understand the history of genetics, gain knowledge basic terminology of genetics
CO2: To acquire knowledge on interaction of genes, various types of inheritance patterns existing inanimals with reference to non-Mendelian inheritance.
CO3: To acquire knowledge on chromosomal inheritance
CO4: Acquiring in-depth knowledge on various of aspects of genetics inv5lved in sexdetermination,
CO5: Acquiring in-depth knowledge on human karyotyping, pedigree analysis and Chromosomaldisorders concepts of proteomics and genomics

SYLLABUS:

UNIT-I:

1.1 History of Genetics- Concepts of Phenotype, Genotype, Heredity, Variation, Pure lines and Inbred Lines
1.2 Monohybrid cross, Di hybrid cross back cross and Test cross and Reciprocal Cross
1.3 Mendelian Principles on Inheritance

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Problem solving on Mendelian principles
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-II:

2.1 Linkage - Definition, Types of linkage-complete linkage and incomplete linkage, Significance of linkage.
2.2 Crossing over - Definition; Mechanism of crossing over, Chiasma Interference and Coincidence
2.3 Gene Interactions: Incomplete dominance, Co dominance, Pleiotropy
2.4 Gene Interactions**:** Lethal alleles, Epistasis, Non- Epistasis

Activity: Assignment /Stssudents Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Model preparation of linkage/crossing overEvaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-III:

3.1 Polygenes (General Characteristics & examples)
3.2 Multiple Alleles (General Characteristics and Blood group inheritance)
3.3 Rh inheritance - HDNB
3.4 Extra chromosomal inheritance- Kappa particles in Paramecium and Shell coiling in snails

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study on Rh/Erythroblastosis foetalis
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV:

4.1 Sex determination- Chromosomal theory and Genic Balance theory
4.2 Sex determination- Hormonal, Environmental and Haplo-diploidy types
4..3 Sex linked inheritance: X-linked inheritance
4.4 Sex linked inheritance: Y-linked & XY-linked inheritance

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Preparation of animated model /chart on sex determination methods
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V:

5.1 Human karyotyping, Pedigree Analysis(basics)
5.2 Chromosomal Disorders (Autosomal Recessive disorder-Sickle cell anaemia, Autosomal Dominant disorder- Huntington disease)
5.3 Basics on Genomics and Proteomics

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Case study of a family for pedigree analysis
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (Suggested)

- Observation of Mendelian / Non-Mendelian inheritance in the plants of college botanical garden or local village as a student study project activity
- Observation of blood group inheritance in students, from their parents and grandparents
- Karyotyping and preparation of pedigree charts for identifying diseases in family history
- Charts on chromosomal disorders

REFERENCE BOOKS:

- Harper, P. (2010). Practical genetic counselling. CRC Press
- Kessler, S. (Ed.). (2013). Genetic counselling: psychological dimensions. Academic Press. 3. Stevenson, A. C., & Davison, B. C. (2016). Genetic counselling. Elsevier.
- Evans, C. (2006). Genetic counselling: a psychological approach. Cambridge University Press.
- References:
- Atlas of Inherited Metabolic Diseases□
- Mendelian Inheritance in Man: A Catalog of Human Genes and Genetic Disorders, Victor A. McKusick,□□ Vol I & II
- Stacy L Blachford (Editor) 2001. The Gale Encyclopedia of Genetic Disorders. Gale Group Publishers, Vol.1 (A-L), Vol.II (M-Z).
- Limoine, W.R. and Cooper, D.NB. 1996: Gene Trophy, Bios Scientific Pub.Oxford.
- REFERENCES:
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings.
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co.
- James D. Watson, Nancy H. Hopkins 'Molecular Biology of the Gene'
- Gupta P.K., 'Genetics

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SEMESTER – III

COURSE 6: PRINCIPLES OF GENETICS

Practical | Credits: 1 | 2 hrs/week

LEARNING OBJECTIVES

- To acquire practical knowledge on the importance of Mendelian principles by solving the problems.
- To provide the required knowledge on the gene interactions
- To acquaint the students on Human karyotype & pedigree analysis basics
- To understand the various genetic concepts through Virtual labs

SYLLABUS:

1. Study of Mendelian inheritance using suitable examples/Problems
2. Study of linkage recombination, gene mapping using the data
3. Study of human karyotypes Blood grouping and Rh in humans
4. Demonstration of prenatal diagnosis (Virtual lab).
5. Amniocentesis demo or virtual lab
6. Demonstration of Ultrasonography (Virtual lab).
7. Chromosomal abnormalities(Clippings/images)
8. Genetic Counselling methods based on case history
9. Construction and analysis of Pedigree

RFERENCE WEB LINKS:

- https://www.iitg.ac.in/cseweb/vlab/anthropology/Experiments/Mendels%20law/index.html
- https://learn.genetics.utah.edu/content/labs/
- https://virtuallabs.merlot.org/vl_biology.html
- https://blog.praxilabs.com/2020/06/30/dna-extraction-virtual-lab/
- https://jru.edu.in/studentcorner/lab-manual/agriculture/Fundamentals%20of%20Genetics.pdf
- https://academicworks.cuny.edu/cgi/viewcontent.cgi?article=1008&context=ny_oers
- https://sjce.ac.in/wp-content/uploads/2018/04/Cell-Biology-Genetics-Laboratory-Manual-17-18.pdf
- https://www.rlbcau.ac.in/pdf/Agriculture/AGP%20113%20%20Fundamentals%20of%20Genetics
- .pdf
- https://coabnau.in/uploads/1610707528_GPB3.2PracticalManual-Final.pdf

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SEMESTER - III
COURSE 7: ANIMAL BIOTECHNOLOGY

Theory **Credits: 3** **3 hrs/week**

Course Objectives:

- To provide knowledge on animal cell and tissue culture and their preservation
- To empower students with latest biotechnology techniques like stem cell technology, genetic engineering, hybridoma technology, transgenic technology and their application in medicine and industry for the benefit of living organisms
- To explain *in vitro* fertilization, embryo transfer technology and other reproduction manipulationmethodologies.
- To get insight in applications or recombinant DNA technology in agriculture, production oftherapeutic proteins.
- To understand principles of animal culture, media preparation.

Course Outcomes::

CO1: Get knowledge of the Vectors and Restriction enzymes used in biotechnology
CO2: Describe the gene delivery mechanism and PCR technique
CO3: Acquire basic knowledge on media preparation and cell culture techniques
CO4: Understand the manipulation of reproduction with the application of biotechnology
CO5: Understand the applications of Biotechnology in the fields of industry and Agriculture including animal cell/tissue culture, stem cell technology and genetic engineering.

SYLLABUS:

UNIT-I:

1.1 Enzymes and Vectors Restriction modification systems: Types I, II and III.
1.2 Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering
1.3 DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases
1.4 Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs,

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Preparation of models of Cloning vectors with biodegradable material/
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT- II:

2.1 Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery

2.2 PCR: Basics of PCR.

DNA Sequencing: Sanger's method of DNA sequencing- traditional and automatedsequencing

2.3 Hybridization techniques: Southern, Northern and Western blotting

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for hands on experience of PCR Use

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-III:

3.1 Natural and Synthetic Cell cultures: primary culture, secondary culture, continuous cell lines

3.2 Organ culture; Cryopreservation of cultures.

3.3 Hybridoma Technology: Cell fusion, Production of Monoclonal antibodies (mAb), Applications of mAb

3.4 Stem cells: Types of stem cells, applications

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to any clinical testing laboratory for observation of various cultures

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV:

4.1 Manipulation of reproduction in animals: Artificial Insemination, In vitro fertilization

4.2 Manipulation of reproduction in animals: Super ovulation, Embryo transfer, Embryo cloning

4.3 Transgenic Animals: Strategies of Gene transfer;

4.4 Transgenic - sheep, - fish; applications

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/ Visit to laboratory for observation of Artificial Insemination, In vitro fertilization/model preparation of transgenic animal

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V:

5.1 DNA fingerprinting

5.2 Application of biotechnology in fisheries – monoculture in fishes, polyploidy in fishes

5.3 Gene therapy-application

5.4 Animal Ethics

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

REFERENCES BOOKS:

- Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
- Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
- Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
- Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
- Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
- Brown TA. (2007). Genomes-3. Garland Science Publishers
- Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.
- Animal Cells Culture and Media, D.C. Darling and S.J. Morgan, 1994.BIOS Scientific Publishers Limited.
- Methods in Cell Biology, Volume 57, Jennie P. Mathur and David Barnes, 1998. Animal Cell Culture Methods Academic Press.
- P.K. Gupta: Biotechnology and Genomics, Rastogi publishers (2003).
- B.D. Singh: Biotechnology, Kalyani publishers, 1998 (Reprint 2001)

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SEMESTER - III

COURSE 7: ANIMAL BIOTECHNOLOGY

Practical **Credits: 1** **2 hrs/week**

LEARNING OBJECTIVES

This course will provide students with a practical knowledge in animal biotechnology, by the completion of the course the graduate shall able to –

- Acquire knowledge on Cloning vectors widely used in biotechnology
- Empower with the process of DNA quantification and amplification
- Explain purification of biological compounds by paper chromatography
- Get insight maintenance of laboratory apparatus
- Understand principles of animal culture, media preparation

SYLLABUS:

1. Cloning Vectors: Plasmid vectors: pBR and pUC series, Bacteriophage lambda and M13 based vectors, Cosmids, BACs, YACs, (Charts/Images/Models)
2. DNA quantification using DPA Method.
3. Techniques: DNA Fingerprinting
4. Separation, Purification of biological compounds by paper chromatography
5. Cleaning and sterilization of glass and plastic wares for cell culture.
6. Preparation of culture media.
7. Amplification of DNA by PCR

Note: above practical may be demonstrated in the lab or demonstrated by V- lab

RFERENCE WEB LINKS:

- https://vlab.amrita.edu/
- https://www.vlab.co.in/broad-area-biotechnology-and-biomedical-engineering
- https://blog.praxilabs.com/2020/06/30/dna-extraction-virtual-lab/
- http://mbvi-au.vlabs.ac.in/
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC203J-lab-manual.pdf
- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BT%200312%20-
- %20ANIMAL%20CELL%20AND%20TISSUE%20CULTURE%20LABORATORY.pdf
- https://davjalandhar.com/dbt/biotechnology/SOP/BSc%20Biotechnology%20Semester%20V%20
- %26%20VI.pdf
- https://www.austincc.edu/awheeler/Files/BIOL%201414%20Fall%202011/BIOL1414_Lab%20 Manual_Fall%202011.pdf

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SEMESTER - III

COURSE 8: EVOLUTION AND ZOOGEOGRAPHY

Theory **Credits: 3** **3 hrs/week**

Course Objectives:

- To provide knowledge on origin of life, theories and forces of evolution
- To explore the evidences of evolution
- To Explain the theories of evolution
- To understand the role of variations and mutations in evolution of organisms
- To understand the zoogeographical distribution of animals

Course Outcomes:

CO1: Understand the principles and forces of evolution of life on earth, the process of evolution of newspecies and apply the same to develop new and advanced varieties of animals
CO2: Explain the different evidences of evolution
CO3: Understand the theories of evolution
CO4: Explain the various tools for evolution
CO5: Map the distribution of animals according to zoological realms

SYLLABUS:

UNIT-I

1.1 Big Bang theory
1.2 Theory of Origin of life: Chemogeny - Primitive atmosphere, formation of macromolecules
1.3 Theory of Origin of life: Biogeny - Coacervates, Microspheres, formation of Nucleic acids, Nucleoproteins Formation of primary organisms, evolution of modes of nutrition, oxygen Revolution, presentday atmosphere, evolution of eukaryotes.
1.4 Miller and Urey Experiment

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-II

2.1 Palaeontological and taxonomical evidences of evolution
2.2 Morphological and anatomical evidences of evolution
2.3 Embryological and physiological evidences of evolution
2.4 Evidences from connecting links, missing links and their bio geographical distribution

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Visit to Archaeological Museum for observation of fossils
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT -III

3.1 Lamarckism-Neo Lamarckism

3.2 Germplasm theory-August Weismann

3.3 Darwinism-Theory of Natural selection

3.4 Modern synthetic theory of evolution (Neo Darwinism)

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV

4.1 Variations-types-sources of variations- importance in evolution

4.2 Mutations- causes-significance in evolution

4.3 Isolation mechanisms-role in evolution

4.4 Sewall wright effect, Hardy Weinberg Principle

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-V

5.1 Animal distribution and barriers of distribution

5.2 Zoogeographical realms – Palearctic regions

5.3 Zoogeographical realms – Neotropical regions

5.4 Zoogeographical realms – Oriental & Australian regions

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Case study on the observation of fauna in the college locality/in the residential area
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (Suggested)

- Chart on industrial melanism to teach directed selection, Darwin's finches to teach genetic drift, collection of data on weight of children born in primary health centres to teach stabilizing selection etc.

REFERENCES BOOKS:

- Ridley, M. (2004). Evolution. III Edition. Blackwell Publishing
- Hall, B. K. and Hallgrimsson, B. (2008). Evolution. IV Edition. Jones and BartlettPublishers
- Douglas, J. Futuyma (1997). Evolutionary Biology. Sinauer Associate
- Minkoff, E. (1983). Evolutionary Biology. Addison-Wesley.
- Organic evolution by Organic evolution by Dr. Veer Bala Rastogi,2019 Kedar Nath Ramnath
- Palaeontology and Zoogeography Organic evolution by Dr. Veer Bala Rastogi,2019 Kedarnath Ramnath
- Rastogi VB. 1991. *Organic Evolution.* Kedar Nath Ram Nath Publications, Meerut, UttarPradesh, India.
- Stahl FW. 1965. *Mechanics of Inheritance.* Prentice-Hall.
- White MJD. 1973. *Animal Cytology and Evolution.* Cambridge Univ.Press

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SEMESTER-III

COURSE 8: EVOLUTION AND ZOOGEOGRAPHY

Practical | Credits: 1 | 2 hrs/week

LEARNING OBJECTIVES

- Acquainting and skill enhancement in the usage of laboratory equipment
- To apply the basic concept of inheritance for applied research
- To get familiar with phylogeny ad geological history of origin & evolution of animals
- To understand the zoogeographical distribution of animals

SYLLABUS:

1. Study of fossil evidences
2. Study of homology and analogy from suitable specimens and pictures
3. Study of embryological evidences by charts/ pictures
4. Study of Lamarckism with images /animations
5. Study of Darwinism with images/ animation
6. Study of connecting links/missing links images/charts
7. Phylogeny of horse with pictures
8. Study of Genetic Drift by using examples of Darwin's finches (pictures)
9. Visit to Natural History Museum and submission of report
10. Mapping distribution of animals according to zoogeographical regions.

RFERENCE WEB LINKS:

- https://www.labster.com/course-packages/evolution-and-diversity
- https://www.biointeractive.org/classroom-resources/stickleback-evolution-virtual-lab
- https://www.youtube.com/watch?v=tXbmPhrS4eA
- https://www.studocu.com/en-us/document/temple-university/bioe-lab-2-biomaterials/1632834116536-zoogeography-assignment/17915777
- https://guides.library.tulsacc.edu/c.php?g=932434&p=6720765
- https://bio.libretexts.org/Courses/Butte_College/BC%3A_BIOL_2_-_Introduction_to_Human_Biology_%28Grewal%29/Text/09%3A_Biological_Evolution/9.3%3A_Evidence_for_Evolution
- https://www.coursehero.com/study-guides/boundless-biology/evidence-of-evolution/

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SEMESTER-IV
COURSE 9: EMBRYOLOGY

Theory **Credits: 3** **3 hrs/week**

Course Objectives:,

The objective of this course is to provide a comprehensive understanding of the concepts of early animal development, methodologies specifically used to study the process of embryonic development in animals, students familiar with different approaches that have been used to study embryology.

Course Outcomes:

The overall course outcome is that the student shall develop deeper understanding of concepts of embryology. This course will provide students with a deep knowledge in embryology by the completion of the course the graduate shall able to –

CO1: Understand the historical perspective and concepts of embryology
CO2: Acquire knowledge on gametogenesis, fertilization and cleavage patterns
CO3: Understand the fate of germinal layers and extraembryonic membranes
CO4: Explain the process of regeneration in certain animals
CO5: Examine the process of organogenesis

SYLLABUS:

UNIT-I:

1.1 Historical perspective and basic concepts: Phases of development
1.2 Cell-Cell interaction, Pattern formation, Differentiation and growth
1.3 Differential gene expression
1.4 Cytoplasmic determinants and asymmetric cell division

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above
Evaluation: Instructor supposed to prepare detailed Rubrics for the evaluation of the above activity

UNIT-II:

2.1 Gametogenesis, Spermatogenesis, Oogenesis
2.2 Types of eggs, Egg membranes; Fertilization (External and Internal)
2.3 Types of Blastulae; Fate maps

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Model preparation on cleavage planes
Evaluation: Instructor supposed to prepare detailed Rubrics for the evaluation of the above activity

UNIT-III:

3.1 Early development of frog and chick up to gastrulation, Fate of Germ Layers
3.2 Extra-embryonic membranes
3.3 Placenta (Structure, types and functions of placenta)
3.4 Amniocentesis

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Chart preparation on the placenta
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV:

4.1 Metamorphosis: Changes, hormonal regulations in amphibians
4.2 Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (in Turbellarians)
4.3 Teratogenic agents and their effects on embryonic development

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Flow chart preparation on the process of metamorphosis highlighting the periodical changes vs hormone activity
Evaluation: Instructor supposed to prepare detailed Rubrics for the evaluation of the above activity

UNIT-V:

5.1 Organogenesis of Central Nervous system in Human
5.2 Organogenesis of Eye, Ear in Human
5.3 Organogenesis of Circulatory system in Human
(* Organogenesis in Human need to be explained)

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Flow chart preparation on the process of organogenesis highlighting the gradual developments of organ systems
Evaluation: Instructor supposed to prepare detailed Rubrics for the evaluation of the above activity

Co-curricular activities (Suggested)

- Preparation of models of different types of eggs in animals
- Chart on frog embryonic development, fate map of frog blastula, cleavage etc.
- Chart on the organogenesis
- RBPT on the Placenta
- Model of extra embryonic membrane
- Laboratory observation of chick embryonic development

REFERENCES BOOKS:

- Developmental Biology by Balinksy
- Developmental Biology by Gerard Karp
- Chordate embryology by Varma and Agarwal
- Embryology by V.B. Rastogi
- Austen CR and Short RV. 1980. *Reproduction in Mammals*. Cambridge UniversityPress.
- Gilbert SF. 2006. *Developmental Biology,* 8th Edition. Sinauer Associates Inc.,Publishers, Sunderland, USA.
- Longo FJ. 1987. *Fertilization.* Chapman & Hall, London.
- Rastogi VB and Jayaraj MS. 1989. *Developmental Biology.* KedaraNath Ram NathPublishers, Meerut, Uttar Pradesh.
- Schatten H and Schatten G. 1989. *Molecular Biology of Fertilization.* AcademicPress, New York.

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SEMESTER-IV
COURSE 9: EMBRYOLOGY

Practical **Credits: 1** **2 hrs/week**

LEARNING OBJECTIVES

- The objective of this course is to provide a comprehensive practical knowledge on the embryology
- Must develop a critical understanding of the early embryological events
- Acquire knowledge on the developmental stages of chick
- Understand the histology of placenta

SYLLABUS:

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of different sections of placenta (photomicrograph/ slides)
4. Project report on chick embryo development

RFERENCE WEB LINKS:

- https://praxilabs.com/en/3d-simulations/cultivation-and-preparation-of-the-virus-in-chick-embryo-virtual-lab
- https://vlab.amrita.edu/
- https://www.vlab.co.in/
- https://www.youtube.com/watch?v=p_tx88He8Pk
- https://core.ac.uk/download/143957972.pdf
- https://egyankosh.ac.in/bitstream/123456789/57549/1/Exercise%207%20Chick%20Embryo.pdf
- http://www.macollege.in/app/webroot/uploads/department_materials/doc_501.pdf
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf

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SEMESTER-IV

COURSE 10: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

Theory **Credits: 3** **3 hrs/week**

Course Objectives:

The objective of this course is to provide knowledge of organ systems function, the ability to integrate physiology from the cellular and molecular level to the organ system and organismic level of organization, to gain a deep knowledge of current topics in physiology.

Course Outcomes:

The overall course outcome is that the student shall develop deeper understanding of concepts of Physiology.

CO1: Understand the physiology of digestion and hormonal control of digestion
CO2: Develop a comprehensive picture of respiratory physiology
CO3: Acquire knowledge on the Renal physiology
CO4: Understand the physiology of Nerve and muscle
CO5: Understand the physiology of heart

SYLLABUS:

UNIT-I: Physiology of Digestion

1.1 Nutrition- type of nutrition, Vitamins and minerals
1.2 Digestive glands and chemical digestion of food;
1.3 Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins;
1.4 Gastrointestinal hormones.

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Chart preparation on the hormonal control of secretion of enzymes
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-II: Physiology of Respiration

2.1 Pulmonary ventilation; Mechanism of respiration, Respiratory volumes and capacities;
2.2 Transport of oxygen in blood and dissociation curves and the factors influencing it
2.3 Transport of Carbon dioxide in blood; dissociation curves and the factors influencing it, Carbon monoxide poisoning

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the CO poisoning/Debate on the dissociation curves
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-III: Renal Physiology

3.1 Structure of kidney and Structure of Nephron

3.2 Mechanism of urine formation

3.3 Regulation of water balance

3.4 Regulation of acid-base balance

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the Urine formation/Working model of Kidney
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT-IV: Physiology of exciting tissues

4.1 Neuron structure and types

4.2 Nerve impulse transmission-(Myelinated, Non-myelinated, synaptic)

4.3 Ultra structure of striated muscle

4.4 Sliding Filament Theory of muscle contraction

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the impulse transmission/Debate on the dissociation curves
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT- V: Physiology of Heart

5.1 Structure of mammalian heart,

5.2 Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses

5.3 Cardiac Cycle

5.4 Nervous and chemical regulation of heart rate. Blood pressure and its regulation

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above /Group discussion on the phases of Cardiac output /case study on the Blood Pressure
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (Suggested)

- Chart on cardiac cycle, human lung, kidney/nephron structure etc.
- Working model of human / any mammalian heart.
- Working model of human / any mammalian urine formation
- Chart/model of sarcomere
- Chart/model on nerve impulse transmission

REFERENCES BOOKS:

- Eckert H. *Animal Physiology: Mechanisms and Adaptation.* W.H. Freeman &Company.
- Floray E. *An Introduction to General and Comparative Animal Physiology.* W.B.Saunders Co., Philadelphia.
- Goel KA and Satish KV. 1989. *A Text Book of Animal Physiology*, RastogiPublications, Meerut, U.P.
- Hoar WS. *General and Comparative Physiology.* Prentice Hall of India, New Delhi.
- Lehninger AL. Nelson and Cox. *Principles of Biochemistry.* Lange MedicalPublications, New Delhi.
- Prosser CL and Brown FA. *Comparative Animal Physiology.* W.B. SaundersCompany, Philadelphia.

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SEMESTER-IV

COURSE 10: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

Practical **Credits: 1** **2 hrs/week**

LEARNING OBJECTIVES

- To acquire knowledge of anatomy of certain important organs.
- To develop the ability to test the biological sample like saliva and urine.
- To Effectively estimate the blood haemoglobin.
- To Acquire skill to use the sphygmomanometer in recording blood pressure.
- To observe the ECG

SYLLABUS:

1. Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney
2. Study of activity of Salivary amylase at different P^H and Temperature
3. Qualitative tests for identification of Carbohydrates
4. Qualitative tests for identification of Proteins
5. Qualitative tests for identification of Fats
6. Urine test for sugar, albumin
7. Estimation of haemoglobin using Sahli's haemoglobinometer
8. Recording of blood pressure using a sphygmomanometer
9. ECG observation- Spotting/identification of curves from the given ECG

RFERENCE WEB LINKS:

- https://www.vlab.co.in/participating-institute-amrita-vishwa-vidyapeetham
- https://library.csi.cuny.edu/oer/virtuallabs-simulations#anatomy
- https://www.labster.com/simulations?course-packages=animal-physiology
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf
- https://physiology.elte.hu/gyakorlat/jegyzet/Physiology_Pactical_(2013).pdf

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SEMESTER - IV
COURSE:11 – IMMUNOLOGY

Theory **Credits: 3** **3 hrs/week**

LEARNING OBJECTIVES

- To promote critical thinking among students.
- To provide students with a foundation in immunological processes
- To provide students with knowledge on how the immune system works building on their previous knowledge
- To clearly state the role of the immune system.
- To compare and contrast the innate versus adaptive immune systems.
- To provide an overview of the interaction between the immune system and pathogens.

LEARNING OUTCOMES:

The overall course outcome is that the student shall develop deeper understanding of concepts of immunology. This course will provide students with a deep knowledge in immunology by the completion of the course the graduate shall able to –

- Articulate the roles of innate recognition receptors in immune responses
- Compare and contrast humoral versus cell-mediated immune responses
- Distinguish various cell types involved in immune responses and associated functions;
- Distinguish and characterize antibody isotypes, development, and functions
- Understand the role of cytokines in immunity and immune cell activation;
- Understand the significance the Major Histocompatibility Complex in terms of immune response and transplantation

SYLLABUS:

UNIT – I: Overview of Immune system

1.1 Introduction to basic concepts in Immunology
1.2 Innate and adaptive immunity
1.3 Cells of immune system
1.4 Organs of immune system

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/Report writing after watching any video on the above/Model chart preparation of cells/organs of immune system
Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT – II : **Antigens**

2.1 Basic properties of antigens
2.2 B and T cell epitopes, paratopes
2.3 Haptens and adjuvants
2.4 Factors influencing immunogenicity

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of organogenesis

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT – III: Antibodies

3.1 Structure of antibody
3.2 Classes of antibodies
3.3 Functions of antibodies
3.4 Monoclonal antibodies

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of antibodies

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT – IV: Working of Immune system

1.1 Structure and functions of major histocompatibility complexes
1.2 Exogenous pathway of antigen presentation and processing
1.3 Endogenous pathway of antigen presentation and processing
4.4. Basic properties and functions of cytokines

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of MHC

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

UNIT – V: Immune system in health and disease

5.1 Gell and Coombs' classification and brief description of various types of hypersensitivities
5.2 Introduction to concepts of autoimmunity and immunodeficiency
5.3 General introduction to vaccines Types of vaccines,
5.4 Organ transplantation- Graft rejection, immune suppressors

Activity: Assignment /Students Seminar/Quiz/Project/Peer teaching/ Model chart preparation of classification of Hypersensitivity

Evaluation: Instructor supposed to prepare a detailed Rubrics for the evaluation of the above activity

Co-curricular activities (suggested)

- Organizing awareness on immunization importance in local village in association with NCC and NSS teams
- Charts on types of cells and organs of immune system
- Student study projects on aspects such as – identification of allergies among students (hypersensitivity), blood groups in the class (antigens and antibodies duly reported) etc., as per the creativity and vision of the lecturer and students

REFERENCES BOOKS:

- Judy Owen, Jenni Punt, Sharon Stranford 2013 Kuby Immunology: International Edition W. H. Freeman
- Abbas AK, 2011, Cellular and Molecular Immunology 7th Ed. Elsevier Health Sciences – India.
- Delves P, Martin S, Burton D, Roitt IM 2011 Roitt's Essential Immunology. 12th Ed. Wiley-Blackwell Scientific Publication, Oxford.
- Murphy K, 2011 Janeway's Immunobiology. 8th Ed. Garland Science Publishers, New York.
- Peakman M, and Vergani D. (2009). Basic and Clinical Immunology. 2nd edition Churchill Livingstone Publishers, Edinberg.
- Richard Coico, Geoffrey Sunshine 2008 Immunology: A Short Course, 6th Edition Wiley-Blackwell
- Sudha Gangal 2013 Textbook of Basic and Clinical Immunology Orient Blackswan Private Limited - New Delhi

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SEMESTER - IV

COURSE 11: IMMUNOLOGY

Practical **Credits: 1** **2 hrs/week**

LEARNING OBJECTIVES

- To acquire knowledge on the distribution of lymphoid organs
- To study the histology of lymphoid organs
- To acquaint with the process of blood grouping with kit
- To acquaint with the ELISA test
- To acquaint with the Widal test

SYLLABUS:

1. Demonstration of lymphoid organs (as per UGC guidelines)
2. Histological study of spleen, thymus and lymph nodes (through prepared slides)
3. Blood group determination
4. Demonstration of ELISA
5. Demonstration of Immunoelectrophoresis
6. Testing for Typhoid antigens by Widal test.
7. Differential Leukocyte Count
8. Isolation of monocytes from blood.
9. Rapid Plasma Reagin (RPR) Test

RFERENCE WEB LINKS:

- https://vlab.amrita.edu/?sub=3&brch=69
- https://ivl1-au.vlabs.ac.in/List%20of%20experiments.html
- https://ivl2-au.vlabs.ac.in/List%20of%20experiments.html
- https://www.medicine.mcgill.ca/physio/vlab/immun/vlabmenuimmun.htm
- http://www.zoologyresources.com/uploadfiles/books/dc64b77d8769325515d17c945e461b45.pdf
- http://www.lucp.net/books-pdf/Lab%20Manual%20Dr.%20Idris%20Adewale%20Ahmed/15.%20BASIC%20IMMUNOLOGY.pdf
- https://www.avit.ac.in/lab/immunology_bioprocess_engineering_lab/download/17BTCC89/lab_manual.pdf
- https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelinger-lab/documents/Immunology-Lab-Manual.pdf
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

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S.G.A. GOVERNMENT DEGREE COLLEGE (A)
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YELLAMANCHILI, ANAKAPALLI DIST., ANDHRA PRADESH

SEMESTER-V
COURSE 12: POULTRY MANAGEMENT-I (POULTRY FARMING)

Theory **Credits: 3** **3 hrs/week**

Course Objectives: The objective of this course is to provide Concept of Poultry Farming

Course Outcomes:
CO1: Evaluate the status of Indian Poultry Industry
CO2: Explain the Scientific Poultry keeping
CO3: Compare the diversified Poultry practices
CO4: Inspect the different breeds of chicken

SYLLABUS:

Unit 1 Indian poultry Industry

1.1 Importance of poultry farming and poultry development in India.
1.2 Present status and future prospectus of poultry Industry
1.3 Classification of poultry based on genetics Utility

Unit -2 Scientific Poultry Keeping

2.1 Modern breeds of Chicken
2.2 Present day egg production lines- meat production lines
2.3 Mini breeds- dwarfism in mini-Leghorns

Unit-3 Diversified Poultry

3.1 Ducks and Geese-classification- rearing system-classification-advantages
3.2 Guinea fouls - guinea fowl farming in India-Production-varieties
3.3 Emu-rearing- Economical aspects-commercial products

Unit-4 Desi Chickens:

4.1 Indigenous breeds and economical aspects of desi chicken
4.2 Indigenous breeds-Aseel-Chittagong-Kadaknath-Bursa
4.3 Improved varieties in India– Giriraja-Vanaraja-Girirani-Kalinga brown, Gramapriya, Swarnandhra

Unit -5 Breeds from Central Avian Research Institute – Izatnagar

5.1 CARI Nirbheek - CARI- Shyama-HITCARI (Naked Neck Cross)
5.2 CARI- Priya Layer, CARI- Sonali Layer,
5.3 CARIBRO-VISHAL, CARI-RAINBRO,
5.4 Nandanam chicken-I, Nandanam Chicken-II, Nandanm-Quail

REFERENCES:

1. Text Book of Poultry Science, P V Sreenivasaiah, Write and Print Publications, ISBN No. 9788192970592, 8192970590
2. Poultry Science Practices, Nilothpal Ghosh, CBS Publication & Distributions, 2015
3. Principles of Poultry Science, 1996, CAB Publishers, ISBN 9780851991221
4. A Text Book of Animal Husbandry, C. C. Banerjee, Oxford and IBH, Publish Co, ISBN: 9788120412606

Web sources:

5. https://www.drvet.in/p/e-books.html
6. https://byjus.com/biology/animal-husbandry-poultry-farming/
7. https://www.helpforag.app/2018/02/livestock-production-and-management-lpm_14.html?m=1

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SEMESTER-V
COURSE 12: POULTRY MANAGEMENT-I (POULTRY FARMING)

Practical **Credits: 1** **2 hrs/week**

LEARNING OUTCOMES:

On successful completion of this practical course, student shall beable to:

- Identify different types of Poultry rearing practices
- Evaluate the efficacy of different types of poultry practices in maximizing yield
- Understand the importance of different hybrid breeds in poultry

SYLLABUS:

1. Different types of Poultry rearing (Students has to observe and draw the different types of poultry rearing systems)
2. Different types of poultry Housing - Models / Images/charts
3. Different layer breeds images/charts/ Models (Observation of characters)
4. Types of broilers images/charts/ Models (Identification of important Characters)
5. CARI breeds characters –images/charts
6. Nandanam breeds- images/charts (Identification of characters)

*** (This practical is 70 % (Web based /virtual) 30% physical: student and teachers must browse the web for the specimens models – write down the important characters based on the web resources)

REFERENCES:

1. A Text Book of Animal Husbandry, C. C. Banerjee, Oxford and IBH, Publish Co, ISBN: 9788120412606
2. http://www.agritech.tnau.ac.in/expert_system/poultry/Poultry%20House%20Construction.html
3. https://petkeen.com/best-chicken-breeds-for-eggs/
4. https://garden.decorexpro.com/en/hozyajstvo/ptitsevodstvo/porody-brojlernyh-kur-s-foto-i-opisaniem.html

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Co-Curricular Activities:

a) **Mandatory**:

1. For Teacher: Training of students by the teacher in laboratory and field on the techniques of identification of layers, broilers and management practices in poultry.
2. For Student: Students shall Individually visit a Poultry farm, make observations and report on the Rearing, Housing, Brooding, Feeding and water management activities. The student shall submit a handwritten Fieldwork/Project work Report on the observations along with pictures in the given format not exceeding 10 pages to teacher.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, detailsof place visited, observations made, findings and acknowledgements*.
5. Unit tests. (IE)

b) Suggested Co-Curricular Activities

1. Web resources – visiting the websites of CARI-IZATNAGA https://cari.icar.gov.in procuring additional information on the poultry breeds
2. Web resources- visiting the website of NANADANAM http://www.tanuvas.ac.in/ippmmadhavaram_tech.html
3. Collection of additional data on different types of Poultry breeds
4. Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited Lecture, Video preparation etc

SEMESTER-V

COURSE 13: POULTRY MANAGEMENT-II

(POULTRY PRODUCTION AND MANAGEMENT)

Theory **Credits: 3** **3 hrs/week**

Course Outcomes:

CO1: Suggest measure for Health care in Poultry

CO2: Evaluate the economics of poultry production

CO3: Elaborate the poultry Breeder flock management

CO 4: Differentiate the poultry hatchery practices

SYLLABUS:

Unit-1 HEALTH CARE

1.1 Common poultry diseases: bacterial, viral, fungal, parasitic .

1.2 Vaccination schedule for commercial layers and broilers . pre and post vaccination care.

1.3 Disinfection: Types of disinfectants; mode of action; recommended procedure; precaution and handling.

Unit-2 ECONOMICS

2.1 Economics of layer and broiler production

2.2 Feasibility studies on poultry rearing- in context of small units and their profitability.

2.3 Export/import of poultry and poultry products.

Unit-3 BREEDER FLOCK MANAGEMENT

3.1 Layer and broiler breeder flock management housing & space requirements

3.2 Different stage of management during life cycle; Light management during growing and laying period, Artificial insemination.

3.3 Feeding: Feed restriction, separate male feeding. Nutrient requirement of layer and broiler breeders of different age groups.

Unit-4 BREEDER HEALTHCARE

4.1 Vaccination of breeder flock

4.2 Common diseases of breeders (Infectious and metabolic disorders)-prevention.

4.3 Fertility disorder- etiology, diagnosis and corrective measures.

4.4 Selection and culling of breeder flocks

Unit-5 HATCHERY PRACTICES

5.1 Management principles of incubation.

5.2 Factors affecting fertility and hatchability. Selection, care and incubation of hatching eggs. break even analysis of unhatched eggs

5.3 Fumigation; sanitation and hatchery hygiene.

5.4 Computer applications for hatchery management

REFERENCES:

1. HVS Chauhan, S. Roy, Poultry Diseases, Diagnosis and Treatment, New Age International Publishers-2018

Web resources:

2. https://www.drvet.in/p/e-books.html
3. https://byjus.com/biology/animal-husbandry-poultry-farming/
4. https://www.helpforag.app/2018/02/livestock-production-and-management-lpm_14.html?m=1

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SEMESTER-V
COURSE 13: POULTRY MANAGEMENT-II
(POULTRY PRODUCTION AND MANAGEMENT)

Practical **Credits: 1** **2 hrs/week**

LEARNING OUTCOMES:

On successful completion of this practical course, student shall be able to:

- Identify Poultry diseases by observation
- Analyze Poultry establishment feasibility
- Understand the Poultry Records

SYLLABUS:

1. Poultry Viral diseases – Observation of histopathological slides
2. Poultry Fungal Diseases- Observation of histopathological slides
3. Poultry Bacterial Diseases-Observation of histopathological slides
4. Feasibility study of Poultry establishment: (Preparation of feasibility study report with given parameters)
5. Rearing of Layers – (Preparation of Flow chart
6. Rearing of broiler- Flow chart
7. Hatchery records- Model study/analysis- Report with modified data

REFERENCES:

1. HVS Chauhan, S. Roy, Poultry Diseases, Diagnosis and Treatment, New Age International Publishers-2018
2. Flow chart hatchery : http://lms.tanuvas.ac.in/mod/resource/view.php?id=45106
3. Feasibility report: https://www.manage.gov.in/stry&fcac/content/19.%20Project%20Report%20on%20Layer%20Poultry.pdf

Co-Curriular Activities

a) Mandatory:

1. For Teacher: Training of students by the teacher laboratory and field on skills in different practices employed in poultry with regard to the disease management – analysis of poultry project- preparation of flow chart – Observation ofPoultry records – computerization activities
2. For Student: students shall (individually) visit a Layer/ Broiler Poultry farming places (small scale/corporate), make observations on practices- resources – management and marketing - analysis and submit a handwritten Fieldwork/Project work Report of 10 pages with necessary images.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, detailsof place visited, observations made, findings and acknowledgements*.
6. (IE): Unit tests.

b) Suggested Co-Curricular Activities

1. Preparation of Poultry diseases charts
2. Preparation of feasibility report poultry establishment with different variables
3. Seminar, Assignment, Group discussion. Quiz, Collection of Material, Invited Lecture, Video preparation etc.

SEMESTER - V

COURSE 14 A: SUSTAINABLE AQUACULTURE MANAGEMENT

Theory **Credits: 3** **3 hrs/week**

LEARNING OUTCOMES:

Students at the successful completion of this course will be able to

- Evaluate the present status of aquaculture at the Global level and National level
- Classify different types of ponds used in aquaculture
- Demonstrate induced breeding of carps
- Acquire critical knowledge on commercial importance of shrimps
- Identify fin and shell fish diseases

SYLLABUS:

Unit: 1

1.1 Present status of Aquaculture – Global and National scenario
1.2 Major cultivable species for aquaculture: freshwater, brackish water and marine.
1.3 Traditional, extensive, modified extensive, semi-intensive and intensive cultures of fish and shrimp.
1.4 Design and construction of fish and shrimp farms

Unit: 2

2.1 Functional classification of ponds – head pond, hatchery, nursery ponds, rearing, production, stocking and quarantine ponds
2.2 Need of fertilizer and manure application in culture ponds
2.3 Physio-chemical conditions of soil and water optimum for culture (Temperature, depth, turbidity, light, water, PH, BOD, CO_2 and nutrients)

Unit: 3

1.1 Induced breeding in fishes
1.2 Culture of Indian major carps: Pre-stocking management (Dewatering, drying, ploughing / desilting; Predators, weeds and algal blooms and their control, Liming and fertilization)
1.3 Culture of Indian major carps - Stocking management, post-stocking management

Unit: 4

4.1 Commercial importance of shrimp & prawn
4.2 *Macrobrachium rosenbergii*- biology, seed production.
4.3 Culture of *L. vannamei* – hatchery technology and culture practices
4.4 Mixed culture of fish and prawns

Unit: 5

5.1 Viral diseases of Fin Fish & shell fish
5.2 Fungal diseases of Fin & Shell fish
5.3 Bacterial diseases of Finfish & Shell fish
5.4 Prophylaxis in aquaculture

REFERENCES:

1. Pillay TVR & M.A.Dill, 1979. Advances in Aquaculture. Fishing News Books Ltd., London
2. Stickney RR 1979. Principles of Warm Water Aquaculture. John Wiley & Sons Inc.1981
3. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsivier ScientificPublishing Company.
4. Bose AN et.al. 1991. Costal Aquaculture Engineering. Oxford & IBH Publishing CompanyPvt. Ltd.

Web resources:

5. http://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6708e/x6708e06.htm
6. http://aquaticcommons.org/1666/1/Better-Practice3_opt.pdf
7. https://www.notesonzoology.com/india/fishery/fish-diseases-symptoms-and-control-fishery/871

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SEMESTER-V
COURSE 14 A: SUSTAINABLE AQUACULTURE MANAGEMENT

Practical **Credits: 1** **2 hrs/week**

LEARNING OUTCOMES:

On successful completion of this practical course, student shall be able to:

- Identify the characters of Fresh water cultivable species
- Estimate physico chemical characteristics of water used for aquaculture
- Examine the diseases of fin and shell fish
- Suggest measures to prevent diseases in aquaculture

SYLLABUS:

a. Fresh water Cultivable species any (Fin & Shell Fish Specimens – Observation of morphological characters by observation and drawings)-5
b. Brackish water cultivable species (Fin &Shell fish- Specimens- Observation of Morphological Character by observing drawing) -5
c. Hands on training on the use of kits for determination of water quality in aquaculture (DO, Salinity, pH, Turbidity- Testing kits to be used for the estimation of various parameters/ Standard procedure can be demonstrated for the same)
d. Demonstration of Hypophysation(Procedure of hypophysation to be demonstrated in the practical lab with any edible fish as model)
e. Viral diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of viral pathogens in fin/ shell fish – one edible specimen can be used for observation of same in the laboratory)
f. Bacterial diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of Bacterial pathogens in fin/ shell fish – One edible specimen can be used for observation of same in the laboratory)
g. Fungal diseases of Fin & Shell Fish (Observation of his to pathological slides / Charts/ Models of Bacterial pathogens in fin/ shell fish – One edible specimen can be used for observation of same in the laboratory)
h. visit to hatchery or culture pond or aqua culture farm – and submission of report

REFERENCES:

i. Boyd CE 1982. Water Quality Management for Pond Fish Culture. Elsevier ScientificPublishing Company
j. http://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6708e/x6708e06.htm
k. http://aquaticcommons.org/1666/1/Better-Practice3_opt.pdf
l. https://www.notesonzoology.com/india/fishery/fish-diseases-symptoms-and-control-fishery/871

Co-Curricular Activities

a. Mandatory:

1. For Teacher: Training of students by the teacher in laboratory/field on Breeding- Induced breeding in carps -hatchery technology of *L. Vennami*- Farming techniques- disease diagnostic techniques—concepts –Demonstration @ any aqua laboratory
2. For Student: Students shall (individually) visit a Hatchery/Farm/ Aqua diagnostic center and make careful observations of the process method and implements- protocols and report on the same in 10 pages hand written Fieldwork/Project work Report.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work**:** Title page, student details, index page, details of place visited, observations made, findings and acknowledgements.
5. (IE). Unit tests.

b. Suggested Co-Curricular Activities

1. Preparation of Model/Charts of Cultivable species of fin fish shell fish
2. Preparation of Model/Chart of Ideal fish Pond- with the standards prescribed.
3. Observation of aquaculture activities in their area (Observation of any activity related toaquaculture in the vicinity of the college/village)
4. Preparation of Model – charts of Fin /Shell fish Diseases with eco-friendly material.
5. Assignments, Group discussion, Seminar, Quiz, Collection of Material, Video preparationetc., Invited lecture

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YELLAMANCHILI, ANAKAPALLI DIST., ANDHRA PRADESH

SEMESTER-V
COURSE 15 A: POSTHARVEST TECHNOLOGY OF FISH AND FISHERIES

Theory **Credits: 3** **3 hrs/week**

LEARNING OUTCOMES: Students at the successful completion of this course will be able to

- Identify the types of preservation methods employed in aquaculture
- Choose the suitable Processing methods in aquaculture
- Maintain the standard quality control protocols laid down in aqua industry
- Identify the best Seafood quality assurance system

SYLLABUS:

Unit – I Handling and Principles of fish Preservation

1.1 Handling of fresh fish, storage and transport of fresh fish, post mortem changes (rigor mortis and spoilage), spoilage in marine fish and freshwater fish.

1.2 Principles of preservation – cleaning, lowering of temperature, rising of temperature, denudation,use of salt, use of fish preservatives, exposure to low radiation of gamma rays.

Unit – II Methods of fish Preservation

2.1 Traditional methods - sun drying, salt curing, pickling and smoking.

2.2. Advanced methods – chilling or icing, refrigerated sea water, freezing, canning, irradiation and Accelerated Freeze drying (AFD).

Unit – III Processing and preservation of fish and fish by-products

1.1 Fish products – fish minced meat, fish meal, fish oil, fish liquid (ensilage), fish protein concentrate, fish chowder, fish cake, fish sauce, fish salads, fish powder, pet food from trash fish, fish manure.

1.2 Fish by-products – fish glue, Using glass, chitosan, pearl essence, shark fins, fish Leather and fish maws.

Unit – IV Sanitation and Quality control

4.1 Sanitation in processing plants - Environmental hygiene and Personal hygiene in processingplants.

4.2 Quality Control of fish and fishery products – pre-processing control, control during processingand control after processing.

Unit – V Quality Assurance, Management and Certification

1.1. Seafood Quality Assurance and Systems: Good Manufacturing Practices (GMPs); Good Laboratory Practices (GLPs); Standard Operating Procedures (SOPs); Concept of Hazard Analysis and Critical Control Points (HACCP) in seafood safety.

5.2 National and International standards – ISO 9000: 2000 Series of Quality Assurance System, *Codex Alimentarius*.

REFERENCES:

1. Santharam R, N Sukumaran and P Natarajan 1987. A manual of aquaculture, Oxford-IBH, NewDelhi
2. Lakshmi Prasad's, Fish Processing Technology 2012, Arjun Publishing House
3. Dr Sunitha Rai, Fish Processing Technology, 2015, Random Publications
4. Safety and Quality Issues in Fish Processing (Woodhead Publishing Series in Food Science, Technology and Nutrition)by H A Bremner K.A Mahanthy, Innovations in Fishing and Fish Processing Technologies, January 2021

Web resources:

5. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=145743
6. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=03

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SEMESTER-V

COURSE 15 A: POSTHARVEST TECHNOLOGY OF FISH AND FISHERIES

Practical **Credits: 2** **2 hrs/week**

LEARNING OUTCOMES:

On successful completion of this practical course, student shall beable to:

- Identify the quality of aqua processed products.
- Determine the quality of fishery by products by observation
- Analyze the protocols of aqua processing methods

SYLLABUS:

1. Evaluation of fish/ fishery products for organo leptic, chemical and microbial quality.
2. Preparation of dried, cured and fermented fish products
3. Examination of salt, protein, moisture in dried / cured products
4. Examination of spoilage of dried / cured fish products, marinades, pickles, sauce.
5. Preparation of isinglass, collagen and chitosan from shrimp and crab shell.
6. Developing flow charts and exercises in identification of hazards – preparation of hazard analysis worksheet
7. Corrective action procedures in processing of fish- flow chart- work sheet preparation

(*Refer the following web sites for complete procedure method and estimations of above listed practical's)

8. Field visit to processing plants

REFERENCES:

1. Dr Sunitha Rai, Fish Processing Technology, 2015, Random Publications
2. https://ecourses.icar.gov.in/e-Leaarningdownload3_new.aspx?Degree_Id=03
3. https://vikaspedia.in/agriculture/fisheries/post-harvest-and-marketing/processing-in- fisheries/fermented-products
4. https://krishi.icar.gov.in/jspui/bitstream/123456789/20500/1/Fermentation%20technology%2 0for%20fish.pdf
5. http://jebas.org/00200620122014/Abujam%20et%20al%20JEBAS.pdf
6. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic%20drying%20and%20packing%20of%20fish.pdf
7. https://krishi.icar.gov.in/jspui/bitstream/123456789/20770/1/Training%20Manual_Hygienic%20drying%20and%20packing%20of%20fish.pdf
8. https://agritech.tnau.ac.in/fishery/fish_byproducts.html
9. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5352841/
10. http://www.fao.org/3/i1136e/i1136e.pdf
11. http://www.fao.org/3/x5989e/X5989e01.htm#What%20is%20sensory%20assessment)

Co-Curricular Activities

a. Mandatory:

1. For Teacher: Training of students by the teacher in laboratory/field in various steps of post-harvest techniques of fishes, on the advanced techniques in post-harvest technology –

Training of students on other employability skills in the Post-harvest sector of Aquaculture Industry- like Processing, Packing, marketing of processed aqua products.

2. For Student: Students shall (individually) visit - Any fish/shrimp Processing Plant/Packing industry and make observations on post harvesting techniques and submit a brief handwritten Fieldwork/Project work Report with pictures and data /survey in 10 pages.
3. Max marks for Fieldwork/Project work Report: 05.
4. Suggested Format for Fieldwork/Project work: *Title page, student details, index page, details of place visited, observations made, findings and acknowledgements*
5. (IE): Unit tests,

b. Suggested Co-Curricular Activities

1. Observation of fish/shrimp processing plants – visit web sites of processing companies andrecord the details of that Unit
2. Interaction with local fishermen to know the method of preservation and details with the available traditional technology
3. Collection of web resources on the Quality assurance, quality control measures in AquaIndustries- cross checking the standards during the visit to any processing units.
4. Assignments, Seminar, Group discussion. Quiz, Collection of Material, invited lectures, Video preparation etc.,